REMARKS

Applicants appreciate the indication of allowable subject matter, but respectfully submit that the remaining claims also are allowable. Please reconsider the application in view of the following remarks.

I. Claim amendments

Certain claims are amended, but in all cases the amendments are intended to correct errors in the claims, and not to distinguish the cited art. In particular, claims 3 and 14, the word "electrically" is added for reasons of antecedent basis. In claims 4, 6, 8, 9 and 15, the term "slug" is replaced by the term "spreader" for reasons of antecedent basis. In claims 8 and 17, the term "thick" is inserted to provide a dimension. In claims 8, 18, 21, and 22 indefinite articles are added due to a lack of antecedent basis. In claim 11, the amendment resolves an error of antecedent basis. Finally, in claims 16 and 20, the term "ball grid array" is added to the body of the claim to be consistent with the preamble.

II. Rejection of claims 1-5, 9-16, 18, and 19

Claims 1-5, 9-16, 18 and 19 are rejected under 35 USC 103 over Tao et al. (U.S. Patent 6,229,7020) (hereinafter "Tao") in view of Shin et al. (US Patent 5,854,511) (hereinafter "Shin"). The rejections are respectfully traversed.

Regarding claim 1, a person of ordinary skill in the art would not modify Tao in view of Shin as the Examiner suggests. The Examiner is using Shin to cover claim 1's recitation that the heat spreader is "attached to the second surface of the die." However, Tao specifically teaches away from contacting a heat sink to the die. In particular, Tao provides Figure 11, which shows a "prior art" heat spreader 81 that contacts the die 83. Col. 1, line 54 *et seq.* However, Tao further states that such an arrangement has several problems, including unreliable bonding between the encapsulant 84 and the heat spreader 81. Col. 1, line 63 to col. 2, line 4. Accordingly, a person of ordinary skill would not modify Tao in view of Shin,

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25 METRO DRIVE
SUITE 700
SAN JOSE, CA 95110
(408) 453-9200
FAX (408) 453-7979

because Tao specifically rejects contact between the heat spreader and the die. Hence, the rejection must be withdrawn.

Further, Tao and Shin both lack claim 1's feature of "an encapsulant completely enclosing the die and the heat spreader." Referring to Tao's Figs. 1, 2A, and 2B, Tao's heat sink 10 includes a protrusion area 101is exposed out of encapsulant 19. While encapsulant 19 covers a peripheral portion of heat sink 10, claim 1 requires that encapsulant "completely" enclose the heat spreader. In Shin's Fig. 1, heat sink 20 is exposed at a bottom surface of the resin 50. Accordingly, the Examiner's combination lacks the encapsulant feature recited above, and the rejection must be withdrawn.

Regarding claim 12, the rejection is respectfully traversed. Tao's "die (11) is electrically coupled by connecting bond wires (16) to the electrical conductive trace (14)." Col. 3, line 5 *et seq.* It is therefore readily apparent that the surface of Tao's die 11 including "active circuitry" is the top surface of die 11to which the bond wires 16 are connected. Accordingly, since claim 1 requires that the "first surface of the die is attached to the first surface of the substrate," claim 12's further feature that the "first surface of the die is the face containing active circuitry" is not shown in either Tao or Shin. Accordingly, the combination lacks a feature of claim 12, and thus the rejection must be withdrawn. Indeed, the rejection of claim 12 is inconsistent with the rejection of claim 2.

Claim 16 includes features of "a heat slug attached to the die" and "an encapsulant completely covering the heat slug." These features are similar to those of claim 1, and hence the arguments made above for claim 1, i.e., that the combination of Tao and Shin is improper and that all features of the claim are not shown in the combination, apply to claim 16 as well. Hence, the rejection must be withdrawn.

Claims 2-5, 13-15, and 19 are dependent on at least one of claims 1, 12, and 16. The rejection of these claims is traversed for at least the same reasons stated above.

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(408) 453-9200
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III. Rejection of Claims 6 and 7

Claims 6 and 7 are rejected under 35 USC 103 over Tao in view of Shin and Yalamanchili (U.S. Patent 5,929,514). The rejections are respectfully traversed for the reasons stated above for claim 1, on which these claims depend.

IV. Rejection of Claims 20-23

Claims 20-23 are rejected under 35 USC 103 over Tao in view of Shin and Marrs (U.S. Patent 5,482,898). The rejections are respectfully traversed.

First, claims 20 and 23 include steps of "encapsulating the die and heat spreader completely," and "completely covering the heat slug with an encapsulant," respectively. For reasons stated above with respect to claim 1, these features are lacking tin Tao and Shim. Regarding Marrs, it is specifically stated that "the surface 101a of the heat sink 101 is exposed . . . to the exterior of the package 110." Hence, Marrs also fails to show the above recited feature of claims 20 and 23. Hence, the rejection must be withdrawn.

Second, claims 20 and 23 include steps of "attaching a heat slug directly to the die," and "attaching a heat slug directly to the second surface of the die," respectively. The Examiner relies on Shim for this feature, but as stated for claim 1, Tao specifically teaches away from such direct attachment. Hence, the combination of Tao and Shin would not be made. Accordingly, the rejection of claims 20 and 23 also should be withdrawn for this additional reason.

Claims 22 and 22 should be allowed in view of their dependence on claim 20.

V. New Claims

New dependent claims 24-47 are added, and are submitted to be allowable over the cited art at least for the reasons stated for their respective independent claim.

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(408) 453-9200
FAX (408) 453-7979

CONCLUSION

The rejections are respectfully traversed, and the claims should be allowed. Please direct comments or questions to the undersigned at (408) 487-1315.

EXPRESS MAIL LABEL NO:
EV 160 615 083 US

Respectfully submitted,

James E. Parsons
Attorney for Applicants
Reg. No. 34,691

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25 METRO DRIVE
SUITE 700
SAN JOSE, CA 95110
(408) 453-9200
FAX (408) 453-7979

Version With Markings to Sh w Changes Made

The claims listed below are amended.

4. (Amended) The die package of Claim 3, [further comprising] wherein bond wires [to] electrically couple the second surface of the die to the first surface of the substrate.

6. (Amended) The die package of Claim 1, further comprising a thin layer of thermal conductive adhesive between the die and the heat [slug] spreader.

8. (Amended) The die package of Claim 1, wherein the encapsulant covering [the] an uppermost portion of the heat [slug] spreader is no more than 9 mils thick.

9. (Amended) The die package of Claim 1, wherein the heat [slug] spreader comprises:

an interior planar portion overlying and attached to the die;

an outer planar portion overlying and attached to at least a portion of the substrate; and

a first angled portion extending from the outer planar portion towards the second surface of the die.

11. (Amended) The die package of Claim 9, wherein the outer planar portion overlies substantially all of the [outer portions of the] substrate.

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14. (Amended) The die package of Claim 13, [further comprising] wherein an array of solder bumps [to] electrically couple the first surface of the die to the first surface of the substrate.

15. (Amended) The die package of Claim 9, wherein a thin layer of encapsulant is located between the outer planar portion of the heat [slug] spreader and the first surface of the substrate.

16. (Amended) A ball grid array (BGA) package, comprising:

a substrate including a ball grid array;

a die coupled to the substrate;

a thin thermal conductive adhesive layer on the die;

a heat slug attached to the die with the adhesive layer; and

an encapsulant completely covering the heat slug.

17. (Amended) The BGA package of Claim 16 wherein the encapsulant covering [the] an uppermost portion of the heat slug is no more than 9 mils thick.

18. (Amended) The BGA package of Claim 16, wherein the heat slug comprises:

an interior planar portion overlying and attached to the die;

an outer planar portion overlying and attached to at least a portion of the substrate; and

a first angled portion extending from the outer planar portion towards [the] an upper surface of the die.

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20. (Amended) A method of dissipating heat from a ball grid array package, comprising:

attaching a die to a substrate including a ball grid array;

attaching a heat slug directly to the die; and

encapsulating the die and the heat spreader completely.

21. (Amended) The method of Claim 20, further comprising leaving a thin layer of encapsulant over [the upper most] an uppermost portion of the heat slug.

22. (Amended) The method of Claim 20, further comprising forming a thin layer of encapsulant between [the] an outer portion of heat slug and [the upper] a surface of the substrate.

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SUITE 700
SAN JOSE, CA 95110
(408) 453-9200
FAX (408) 453-7979